TITLE OF THE INVENTION

AN IMAGE PRINTING APPARATUS AND A WHITE LINE COMPENSATION METHOD THEREFOR

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Application No. 2002-59353, filed September 30, 2002, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] An aspect of the present invention relates to an image printing apparatus and a white line compensation method therefor, and more particularly, to an image printing apparatus and a white line compensation method therefor that compensates for white lines produced at the rear portion of a sheet of recording paper when the sheet comes out of a feeding roller.

2. Description of the Related Art

[0003] In general, a facsimile machine, a printer, a multi-function machine that comprises multiple functions of a facsimile machine and a printer in one device, or other similar units are manufactured to have a printing function in common, and thus, are equipped with an image printing apparatus to complete a printing function.

[0004] Such an image printing apparatus is classified as an inkjet printer or a laser printer based on the printing method of a printing engine.

[0005] The inkjet printer has an ink cartridge in which plural nozzles are formed to fire ink, and an ink cartridge driving circuit to drive the ink cartridge in order to form an image on a recording sheet of paper in response to a printing command.

[0006] FIG. 1 is a cross-sectioned view schematically showing a conventional inkjet printer.

[0007] As shown in FIG. 1, an inkjet printer includes: a pickup roller 120 to pick up recording sheets of paper P loaded in a paper supply cassette 110; a paper feeding part 130 disposed at a predetermined interval to feed a sheet of paper P picked up by the pickup roller 120; a printing part to carry out printing operations; and a paper discharge part 140 to externally discharge a printing-completed recording sheet of paper P.

[0008] According to a printing process of the inkjet printer structured as above, a recording sheet of paper P loaded in the paper supply cassette 110 is picked up by the pickup roller 120. The picked-up sheet of paper P is placed in a printing area along a sheet feeding path 100 by the paper feeding part 130. If the sheet of paper P is fed into a printing area, the ink cartridge 150 fires ink on the sheet of paper P fed and forwards the sheet of paper P to carry out the printing job, reciprocating the printer head (not shown) to the left and right.

[0009] Consequently, the sheet of paper P on which an image is printed by the ink cartridge 150 is externally discharged along a paper discharge direction by the paper discharge part 140. As a result, a white line is produced due to a backlash phenomenon of a feeding roller 130a at the time the feeding sheet of paper P goes out of the feeding roller 130a and the friction roller 130b of the paper feeding part 130 disposed at a position where the feeding sheet of paper P enters the printing area.

[0010] That is, as shown in FIG. 1, in case the rear portion of the sheet of paper P moves from position a to position b, in other words, during the time the sheet of paper P moves out from between the feeding roller 130a and the friction roller 130b, the sheet of paper P is overfed as much as the sheet of paper P is fed by the paper feeding part 130 and the paper discharge part 140. Accordingly, a problem occurs since a white line is produced as, denoted A in FIG. 2, on the rear portion of the sheet of paper P, resulting in deterioration of the printing quality.

SUMMARY OF THE INVENTION

[0011] Accordingly, it is an aspect of the present invention to provide an image printing apparatus and a white line compensation method therefor capable of controlling a feeding amount of a sheet of a paper in consideration of a position at which a white line is produced depending upon a size the sheet of paper, to compensate the printing quality.

[0012] The foregoing and/or other aspects of the present invention are achieved by providing: an image printing apparatus that includes at least one pair of feeding rollers disposed

in pairs in a vertical direction at a predetermined interval to feed a sheet of recording paper picked up by a pickup roller along a sheet feeding path; a document position sensor to detect whether the sheet picked up by the pickup roller reaches a set reference position; a storage unit to store information about the position of the sheet at which a white line would be produced wherein the storage unit stores the information regarding sheet size; a printing part to print an image as the sheet is fed into a printing area; and a control unit to control a feeding rate of the feeding rollers using the information stored in the storage unit regarding the white line producing position of the sheet, wherein the sheet is fed at an initially set feeding rate starting when the sheet is detected to have reached the reference position via the document position sensor until the time the white line would be produced, and then the sheet is fed at a different feeding rate from the initially set feeding rate starting from the time when the white line would be produced on the sheet of paper.

[0013] Additional aspects and advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0014] The control unit stops driving the feeding rollers for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper.

[0015] The control unit controls the feeding rate of the feeding rollers such that the sheet of paper is fed at a feeding rate of the feeding rollers less than the initially set feeding rate for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper.

[0016] According to an aspect of the present invention, a white line compensation method of an image printing apparatus having a pickup roller comprises: at least one pair of feeding rollers disposed in pairs at a predetermined interval in a vertical direction to feed a sheet of paper picked up by the pickup roller along a set sheet feeding path; a storage unit to store information about the position of the sheet of paper at which a white line would be produced, the storage unit to store the information by sheet size; and a printing part to print an image as the sheet of paper is fed into a printing area, which includes the operation of being input in accordance with the information on sheet sizes of the sheet of paper, feeding along the set sheet feeding path the sheet of paper picked up by the pickup roller, detecting whether the sheet of paper reaches a set reference position, and upon determining that the sheet of paper reaches the set reference

position, controlling a sheet feeding rate by using the information on positions at which the white line would be produced depending on the sheet size information.

[0017] The control operation stops driving the feeding rollers for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper.

[0018] The control step feeds the sheet of paper at a feeding rate of the feeding rollers less than the initially set feeding rate for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] The above and/or other aspects and advantages of the invention will become apparent, and more readily appreciated from the following description of the preferred embodiment, taken in conjunction with accompanying drawings, of which:

FIG. 1 is a view of a conventional inkjet printer;

FIG. 2 is a view for showing an illustrative image outputted in use of the inkjet printer of FIG. 1;

FIG. 3 is a block diagram for showing a multi-function machine having an image printing apparatus according to a preferred embodiment of the present invention;

FIG. 4 is a view for schematically showing a printing unit of FIG. 3; and

FIG. 5 is a flowchart illustrating a white line compensation method of the multi-function machine shown in FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Reference will now be made in detail to the present preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to the like elements throughout. The embodiments are described below in order to explain the present invention by referring to the figures.

[0021] A block diagram of a multi-function machine having an image printing apparatus according to a preferred embodiment of the present invention is shown in FIG. 3.

[0022] Referring to FIG. 3, a multi-function machine 200 according to an aspect of the present invention has an operating panel (OPE) 210, a Personal Computer (PC) interface 220,

a storage unit 230, a scanning unit 240, a printing unit 250, a sensor unit 260, a facsimile unit 270, and a control unit 280.

[0023] The OPE 210 is provided with an input part (not shown) having plural function keys to support character and/or number inputs in order to enable various functions supported by the multi-function machine 200 to be set and function keys enabling information on sheet sizes to be inputted. The OPE 210 also comprises an LCD window (not shown) to indicate the operation states of the multi-function machine 200 according to the controls of the control unit 280 to be described later. The OPE 210 outputs key data generated based on the manipulation of keys provided in the input part to the control unit 280.

[0024] The PC interface 220 supports data communications between a personal computer (PC) 300 of external device and the control unit 280 through a communication interface (P1284 or USB cable). Accordingly, the PC interface 220 receives printing data transmitted from the PC 300 based on the controls of the control unit 280 and uploads to the PC 300 data read out by the scanning unit 240, which is described later, and an electric power supply state of the multi-function machine 200.

[0025] The storage unit 230 is constructed with a non-volatile memory such as a ROM to store various control programs necessary to implement the functions of the multi-function machine 200, and a volatile memory such as a DRAM to temporarily store image data read out by the scanning unit 240 based on the controls of the control unit 280, facsimile data received from the facsimile unit 270 to be described later, and printing data transmitted from the PC 300.

[0026] Further, in the storage unit 230 is stored information corresponding to a position at which a white line would be produced depending upon sheet sizes. The positions at which the white line is produced depending upon sheet sizes are fixed so that standard positions on which the white line is generated can be set.

[0027] The scanning unit 240 scans data printed on a sheet of paper like a general scanner to covert the scanned data into a format that the control unit 280 can recognize. The scanned data of the scanning unit 240 is temporarily stored in the storage unit 230. The scanned data stored in the storage unit 230 is transmitted to the printing unit 250 to print according to the controls of the control unit 280, or can be transmitted to the PC 300 through the PC interface 220.

[0028] The sensor unit 260 detects the operation states of individual peripheral devices according to the operations of the multi-function machine 200. That is, the sensor unit 260 checks if the peripheral devices such as the scanning unit 240, printing unit 250, PC interface 220, facsimile unit 270, etc., are normally operating. The checked data is transmitted to the control unit 280, and the control unit 280 indicates the data on the LCD window provided on the OPE 210. Therefore, a user can see the operation states of various peripheral devices through the LCD window.

[0029] The facsimile unit 270 includes a Telephone Answering Machine (TAM) 272 having an automatic answering function, a modem 274, and a Line Interface Unit (LIU) 276.

[0030] The modem 274 receives and transmits facsimile data from and to external devices connected to the Public Switched Telephone Network (PSTN) through the LIU 276.

[0031] The LIU 276 connects to enable mutual communications between the modem 274 and the PSTN to allow to facsimile data to be received and transmitted. The facsimile data received through the PSTN is transmitted to the control unit 140 through the modem 274 and the LIU 276.

[0032] The printing unit 250 carries out printing jobs with respect to data to be printed according to the controls of the control unit 280.

[0033] The printing unit 250 has a motor driver 252 and a printer head driver 256. The motor driver 252 drives a carriage return (CR) motor 253 and a line feed (LF) motor 254 according to the controls of the control unit 280. The CR motor 254 is driven by the motor driver 252 to transport the ink cartridge 150. The LF motor 253 is driven by the motor driver 252 to transport the sheet of paper for the recording of print data.

[0034] The printer head driver 256 drives a printer head 258 to fire ink via nozzles provided in the printer head 258, to thereby print an image on a sheet of paper. The printer head 258 is a recording head in which plural nozzles having discharge holes formed therein are arranged and driven by the printer head driver 256.

[0035] The control unit 280, if the multi-function machine 200 is turned on, controls the overall operations of the multi-function machine 200 according to a control program stored in the storage unit.

[0036] The control unit 280 checks if information regarding the size of a sheet of paper queuing to print is inputted through the input part. If the information on the sheet size is inputted, the control unit 280 uses the size information regarding the sheet size to recognize, via the storage unit 230, a position of the sheet of paper at which the white line would be produced.

[0037] A sectional view to schematically illustrate the printing unit of the multi-function machine in FIG. 3 is shown in FIG. 4. The same functions as the members shown in FIG. 1 are indicated by the same reference numerals, and duplicated descriptions will be avoided.

[0038] Referring to FIG. 4, a document position sensor 262 is disposed on the sheet feeding path 100 near a location where a sheet of paper P loaded in the paper supply cassette 110 is picked up by the pickup roller 120. The document position sensor 262 is a sensor to detect whether a sheet of paper P fed along the sheet feeding path reaches a set reference position.

[0039] If the control unit 280 receives a detection signal generated by the document position sensor 262 detecting that a sheet of paper P has reached the set reference position, the control unit 280 drives the LF motor 253 to feed the sheet of paper P to a printing position. The sheet of paper P moves along the sheet feeding path 100 set by the paper feeding part 130 rotating with the driving of the LF motor 253. The ink cartridge 150 is driven by the CR motor 254, and fires ink on the sheet of paper P while reciprocating the printer head (not shown) to the left and to the right directions to carry out printing jobs.

[0040] Further, if the control unit 280 decides through the document position sensor 262 that the sheet of paper P reaches the set reference position, the control unit 280 controls the sheet of paper P to be fed at an initially set feeding rate from the time when the sheet of paper P is detected to have reached at the set reference position to the time when the white line would be produced. The control unit 280 processes the sheet of paper P to be fed at a rate different from the initially set feeding rate for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper P.

[0041] That is, the control unit 280 stops driving the LF motor 253 for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper P. Alternatively, the control unit 280 controls the LF motor 253 for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper P to feed the sheet of paper P at a rate less than the initially set feeding rate.

[0042] In the meantime, the control unit 280, after a predetermined period of time lapses from the time when the white line would be produced on the sheet of paper P, processes the sheet of paper P to be fed at the initially set feeding rate.

[0043] Hereinafter, a white line compensation method of a multi-function machine having the image printing apparatus according to an embodiment of the present invention will be described with reference to FIG. 5.

[0044] Referring to FIG. 3 to FIG. 5, if the multi-function machine is powered on, the control unit 280 checks whether information regarding a size of a sheet of paper P is inputted through the OPE 210 (S400).

[0045] If the sheet size information is inputted through the OPE 210, the control unit 280 feeds along the sheet feeding path 100 the sheet of paper P picked up by the pickup roller 120 based on a printing command (S410).

[0046] The document position sensor 262 detects whether the sheet of paper P reaches a set reference position and outputs a signal of the detection result to the control unit 280. The control unit 280 decides whether a signal of the document position detection result is received from the document position sensor 262 (S420).

[0047] If the sheet of paper P is determined to have reached the reference position in the step S420, the control unit 280 drives the paper feeding part 130 at the initially set feeding rate, and carries out a printing job to print an image on the sheet of paper P being fed (S430).

[0048] In the meantime, the control unit 280 can predict the time when the white line would be produced on the sheet of paper P by using the sheet size information. Accordingly, the control unit 280 checks a printing progress state starting from the time the sheet of paper P reaches the set reference position and determines whether the sheet of paper P is fed up to the position where the white line would be produced (S440). That is, the control unit 280 decides whether the rear end portion of the sheet of paper P is fed out of the feeding roller 130a and the friction roller 130b.

[0049] If the sheet of paper P is determined to have been fed up to the position at which the white line would be produced, the control unit 280 controls the LF motor 253 for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper P to stop feeding the sheet of paper P (S450).

[0050] Further, the control unit 280 stops feeding the sheet of paper P only for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper P, and feeds the sheet of paper P at the initially set feeding rate after the predetermined period of time lapses, to thereby continue the printing job.

[0051] The control unit 280 determines whether the printing job is completed (S460). Upon determining that the print job is complete, the sheet of paper P, which has gone through the printing process, is externally discharged in the discharge direction of the paper discharge part 140.

[0052] As stated above, the white line produced at the time the sheet of paper P goes out of the feeding roller 130a and the friction roller 130b can be prevented by controlling the feeding rate of the sheet of paper P at the time the white line would be produced on the sheet of paper P.

[0053] As described so far, the image printing apparatus and the white line compensation method according to an aspect of the present invention uses information on positions set by sheet sizes at which the white line would be produced to control the sheet feeding rate for a predetermined period of time starting from the time when the white line would be produced on the sheet of paper, to thereby prevent the white line phenomenon so that printing quality can be enhanced.

[0054] Although few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in this embodiment without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.